2001 Summary of Engineering Research

This pdf file is part of the larger *2001 Summary of Engineering Research,* available on the Web at http://www.engr.uiuc.edu/Publications/engineering_research/ and on CD-ROM. The *Summary of Engineering Research* represents the extensive engineering research program at the University of Illinois at Urbana-Champaign. The efforts of faculty, professional staff, and graduate students working on more than 1,600 projects during the calendar year 2000 are summarized in the larger report.

Detailed statistics about research in the College of Engineering are included in the *Directory of Engineering and Engineering Technology Programs and Research,* published by the American Society for Engineering Education.

How to use the *Summary of Engineering Research:* Research projects are listed by title, followed by the names of the investigators and the sponsoring agencies. Projects are sorted by major topic areas. Project descriptions are brief. Additional information on each project may be obtained from the investigator in charge (denoted by an asterisk). Mailing addresses are provided on the introductory pages to each department or laboratory.

How to obtain publications: Information about technical reports is available from the Engineering Documents Center, 157 Grainger Engineering Library Information Center, 1301 West Springfield Avenue, Urbana, IL 61801, USA; http://www.library.uiuc.edu/grainger/.

Ph.D. theses can be found at the University of Illinois Library, http://www.library.uiuc.edu/. Ph.D. theses may be purchased from University Microfilms, 300 Zeeb Road, Ann Arbor, MI 48106, USA; http://www.umi.com.

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COLLEGE OF ENGINEERING

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Agricultural Engineering

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Principles from many scientific and engineering disciplines are applied to address opportunities and problems of agricultural production, processing, and utilization. Food and agribusiness industries account directly or indirectly for more than 20 percent of the U.S. Gross National Product and are the world's largest industries. Illinois is ranked second nationally in the value of food processed and fifth in total value of agricultural products.

The research program areas of the department include environmental protection of air, soil, and water resources; bioenvironmental engineering of plant and animal production facilities; off-road power and machinery design; and food and process engineering. Alternative energy technologies, such as ethanol, biomass conversion, solar, vegetable oil, and agricultural waste utilization, continue to be explored along with efficient management of conventional energy sources. More cooperation with industries that purchase, transport, process, and package agricultural commodities has broadened the scope of agricultural engineering research, especially in the development of monitoring sensors and process control systems using machine vision and other sensors. Research aimed at improving performance and reducing cost at all levels of production with minimal environmental impact is receiving considerable attention in an attempt to keep U.S. agricultural products competitive in the world market. Additionally, new markets, new products, and new uses are being sought for overly abundant agricultural commodities.

Geographically located in an area of intense agricultural production, with access to good transportation facilities and surrounded by a large concentration of agricultural and industrial equipment manufacturers and food processors, the department is in an enviable position to serve all areas of the agricultural community. Many agricultural engineering graduates, educated and trained in the University of Illinois' Agricultural Engineering Sciences Building with modern teaching facilities and research laboratories, are employed throughout the nation. Interaction and cooperation with these graduates and other alumni scattered throughout the world help maintain a viable, useful research program.

Agricultural Safety

Developing a Fall Arrest System for Grain Bins

R. A. Aherin,* G. L. Riskowski
University of Illinois

The purpose of this research is to design and test a system(s) that can be incorporated into the design of existing and new grain bins that will prevent falls and suffocation of persons who enter bins on farms. The intent is to develop a system that will allow workers to accomplish needed tasks and provide protection from falling through crusted-over grain and suffocating or experiencing other fall-related injuries. A system has been designed and tested. The industry is currently being informed of the results. Future enhancement of the design may be necessary.

Disabled Farmers Project

R. A. Aherin,* R. E. Petrea
University of Illinois; U.S. Department of Agriculture

The primary objective of this project is to develop a model program that will provide comprehensive assistance to Illinois farmers with physical disabilities. This includes conducting research to identify the level of need for assistance among farmers in the state and the impact of services provided.

Farm Injury Medical System Surveillance

R. A. Aherin*
Carle Foundation Hospital Center for Rural Health and Farm Safety

The purpose of this project is to develop and test a farm injury and illness surveillance system for three primary sources of data within a medical system. These include patient admittance to emergency rooms, hospitals, and clinics. The systems developed will be evaluated for reliability and ease of use by admittance personnel.

* Denotes principal investigator.

Respiratory Health of Swine Workers Pilot Study

R. A. Aherin,* D. Main
National Institute for Occupational Safety and Health; National Farm Medicine Center; Carle Foundation Hospital Center for Rural Health and Farm Safety

The first year of the project is a pilot study that may lead to a more comprehensive four-year study. The long-term objective is to safeguard respiratory health of confinement workers by developing technologies to measure, predict, and control airborne contaminants in swine production facilities. The objectives of the first-year pilot project are to evaluate the risk level by surveying the respiratory health history and the exposure to airborne contaminants of swine confinement workers and to measure the acute respiratory responses (FEV1, FEF25-75, FEF75 and FVC) of swine confinement workers who are exposed to the environments of confinement livestock facilities.

Reducing Eye Injuries and Illnesses in Latino Farm Workers

L. Forst,* S. Scimshaw, D. Hryhorczuk, R. Petrea, S. Bauer, T. Booker, L. Nickels, R. Kerzee
Centers for Disease Control and Prevention

This is a study to develop and assess intervention strategies designed to reduce the incidences and severity of work-related eye injuries and illnesses in Latino farm workers in Illinois and Michigan. Goals are to describe the current control methods utilized; determine the intentions and prominent beliefs toward utilizing control strategies during farm work; deliver an intervention program based on those intentions and prominent beliefs; evaluate the effects of the intervention program; establish a long-range eye injury and illness prevention program; and build partnerships among university researchers, advocacy groups, service providers, Latino farm workers, and local health care professions.

Coordinator for the Agricultural Safety and Health Network (ASH-NET)

R. E. Petrea*
W. K. Kellogg Foundation

This study uses qualitative methods to assess the group processes and leadership development strategies effective in continuing a national network of individual agricultural safety- and health-related projects. The coordinator role serves to facilitate the activities of a variety of university, medical center, and community-based entities in jointly addressing safety and health issues and catalyzing grassroots efforts to educate policy makers relevant to this arena.

Using History and Accomplishments to Plan for the Future: A Summary of 15 Years in Agricultural Safety and Health and Action Steps for Future Directions

R. E. Petrea*
Multiple Funding Agencies

This three-year project uses a conference in year one and a consensus building process in years two and three to provide content for a published document. This document on agricultural safety and health will summarize recent past activities, describe progress made, identify current gaps and needs, anticipate changes in the future for the public record, and serve as a resource in national policy discussions.

Youth Teaching Youth: Are TASK Teens Ready to Teach?

R. E. Petrea,* R. A. Aherin, P. Buriak
National Institute of Occupational Safety and Health

This three-year research provides the first formal, overall evaluation of a prominent youth-teaching-youth model, the Illinois Easter Seal Society's Teaching Agricultural Safety to Kids (TASK). TASK trains secondary-age FFA members to make presentations on agricultural and rural safety and health issues to elementary school students. Quasi-experimental quantitative, behavioral psychology, and qualitative methods are used to observe and evaluate the training that FFA members receive, to observe and appraise the presentations that FFA members make in elementary schools, and to test the immediate and one-year impacts of TASK presentations on elementary students.

Alternative Fuels

Evaluation of Biomass-Derived Alternative Fuels for Off-Road Vehicles

A. C. Hansen*
U.S. Department of Agriculture Hatch Funds

More stringent emissions regulations and increasing reliance on imported crude oil has renewed interest in biofuels. The objective of this project is to evaluate selected biomass-derived fuels in off-road vehicles in terms of engine performance, durability, and emissions. Fuel blends will be tested in the laboratory and field. Laboratory tests will include the optimization of engine parameters so as to minimize emissions and maximize performance.

* Denotes principal investigator.

Evaluation of "E diesel" as an Alternative Fuel for Diesel Engines

A. C. Hansen,* Q. Zhang
Illinois Department of Commerce and Community Affairs

The purpose of this project was to perform a 500-hour engine durability test in the laboratory to evaluate the effect of E diesel, a blend of ethanol and diesel fuel, on the performance of an engine and on the life of the fuel system and engine components. The test procedure was developed in cooperation with Cummins Engine Company, the manufacturer of the test engine, for comparison with the standardized data available for the same test using #2 diesel as the fuel. The potential benefits of using E diesel are both economic and environmental.

Evaluation of "E diesel" as an Alternative Fuel in Agricultural Machinery

A. C. Hansen,* Q. Zhang, R. Hornbaker
Illinois Council on Food and Agricultural Research; Great Lakes Regional Biomass Energy Program

The objective of this project is to determine the suitability of E diesel, a blend of ethanol and diesel fuel, for on-farm use, including its performance, fuel interchangeability, and serviceability characteristics as well as its economic impact. Testing will take place on the farms of participating farmers with two tractors and two combines being monitored for performance and condition. A standard test procedure for on-farm fuel evaluation will be developed in the course of the research. The Illinois Corn Growers Association and Deere & Company are the industrial partners in conducting this research.

Bioenvironmental Engineering

Agricultural Ventilation Equipment

L. L. Christianson,* S. E. Ford, T. L. Funk, G. L. Riskowski, Y. Zhang
Various manufacturers and electric power suppliers; National Pork Producers Council; University of Illinois; Electric Power Research Institute

Factors that affect performance of agricultural ventilation equipment are evaluated (fans, heat exchangers, inlets, evaporative pads). Results for commercially available equipment are published in booklet form and distributed by extension engineers and electric utilities. This project is in cooperation with electric power suppliers, swine producers, and fan manufacturers.

Bioenvironmental Engineering Research Laboratory

L. L. Christianson,* M. E. Tumbleson, R. J. Adrian, M. Ellis, S. M. Larson, R. I. Mackie, M. T. McCulley, T. A. Newell, G. L. Riskowski, M. J. Rood, W. B. Rose, M. A. Smith, L. A. Spomer
National Science Foundations; U.S. Environmental Protection Agency; American Society of Heating, Refrigerating and Air-Conditioning Engineers; Center for Indoor Air Quality Research; U.S. Department of Agriculture; U.S. Department of Energy; University of Illinois

(In cooperation with the Departments of Animal Sciences, Natural Resources and Environmental Sciences, Civil and Environmental Engineering, Mechanical and Industrial Engineering, Nuclear Engineering, and Theoretical and Applied Mechanics; College of Veterinary Medicine; and the Small Homes Council/Building Research Council)

An interdisciplinary research laboratory was established involving faculty from engineering and biological sciences. The purposes are to characterize and assess the microenvironment and its effects on organisms and biological products. Focus areas include animal and plant interactions with their microenvironments, sensors and instrumentation, indoor air quality, air and air contaminant movement, environmental conditioning equipment, and building materials.

Solid/Liquid Separation of Waste Using Gravity and Automatic Solid Removal

T. L. Funk,* Y. Zhang, J. Polakow
Illinois Council on Food and Agricultural Research

This project is to develop and evaluate a solid/liquid separation system for waste treatment using gravity settling and an automatic solid removal to minimize the maintenance and cost. Primary influent will be first settled in a settling basin with a sedimentation chamber, and an auger system will remove the solids periodically. The separated solids can then be used for further processing, such as thermochemical conversion, composting, or digestion. The liquid, which is low in biochemical oxygen demand (BOD), can be aerated mechanically or naturally without much odor emission.

* Denotes principal investigator.

Variable Rate Technology Slurry Applicator

T. L. Funk*
Illinois Council on Food and Agricultural Research

In Illinois, the most popular way of spreading swine manure, by slurry tank, has a serious shortcoming: it is very difficult to estimate and control the rate at which the slurry flows from the tank to the soil-injection equipment. Without better controls, the producer cannot assure the public that manure is being applied to land at environmentally acceptable rates. This project will develop a simplified, accurate system for controlling flow rate and the ability to couple the control with other hardware and software related to site-specific precision agriculture methods.

Bioenvironmental and Structural Systems Laboratory

G. L. Riskowski,* L. L. Christianson, S. E. Ford
Acme Aerotech; GSI Group; Hired Hand; Multifan; Raydot; University of Illinois

A series of tests were conducted on how design and application affect performance of ventilation equipment. Equipment tested included agricultural fans, grain-drying fans, evaporative pads, air diffusers, and building ridge vents.

Illinois Odor and Nutrient Control Proving Center

G. L. Riskowski,* L. Y. Zhao, Y. Zhang, M. E. Ellis, Y. Huyn
Illinois Council on Food and Agricultural Research

Before results from laboratory studies can be recommended to livestock producers, they need to be verified in larger scale studies that can include the effects of multivariables. A proving center with larger scale production facilities has been developed to test technologies for odor control that were successful in small-scale studies. Air ozonization and wet scrubbers on exhaust fans were tested.

Analysis and Development of a Noncontact Aerodynamic Deduster

Y. Zhang,* Z. C. Tan, G. L. Riskowski
American Society of Heating, Refrigerating and Air-Conditioning Engineers; Illinois Council on Food and Agricultural Research

Existing dust removal equipment is limited in application to animal facilities, especially in farm animal buildings, as it requires frequent cleaning and/or replacement of filters. The limitation is primarily due to the contact filtration process. In this study, a prototype of a noncontact, aerodynamic deduster will be developed to separate dust particles from an air stream. Theory of particle cut size will be reviewed and modified. Parameters such as the deduster configurations and turbulence intensity affecting the cut size and particle separation efficiency will be determined. Data collected will be used to validate the theory.

Characterization of Dust Particles from Animal Buildings

Y. Zhang,* X. L. Wang, G. L. Riskowski
Cooperative State Research Service, U.S. Department of Agriculture; University of Illinois

An air quality laboratory has been established in the Department of Agricultural Engineering. Grants from the sponsors enabled researchers to acquire a state-of-the-art aerodynamic particle sizer and the accessories. Particle size distribution, number and mass concentrations, and microbiological compositions of dust from animal buildings will be characterized to aid in developing air-quality control strategies. Together with gas chromatography, mass spectrometry, and other instrumentation, such as a multipoint air sampler, a laser particle counter, and an Anderson sampler, the laboratory becomes one of the best equipped laboratories for air quality research in the nation.

Critical Flow Control Devices for Measurement of Dust Spatial Distributions

Y. Zhang,* X. L. Wang
University of Illinois

The existing aerosol sampling technology is a single point measurement; that is, it is one measurement at one point at a time. To study the aerosol spatial distribution and behavior, it is critical to measure aerosol concentrations across an airspace at multipoints during the same time period. Otherwise, the time required for each measurement point will introduce large errors in aerosol distribution patterns, which are highly time dependent. A critical air flow (air speed at the speed of sound) device is being developed. The device will be able to maintain an accurate airflow regardless of the pressure. The device will be used to develop a multipoint aerosol sampler that can measure dust concentration at multiple points at the same time.

* Denotes principal investigator.

Develop and Evaluate a Low Cost Inflatable Cover for Earthen Manure Lagoon to Reduce Odor Emissions

Y. Zhang,* G. L. Riskowski, T. L. Funk, R. Hussey
Illinois Council on Food and Agricultural Research

Researchers are developing a low-cost inflatable lagoon cover for rectangular shaped earthen lagoons. Expected results of this study will likely be an economical and practical method for reducing odor from lagoons, preventing rainfall collection, and preventing accidental spillovers. Fertilizer values will also be preserved with the covered lagoon. The odor emissions for the lagoon will be substantially reduced. The lagoon will be hidden from sight. Thus, the perception of odor will be eliminated.

Development of 3-D Particle Image Velocimetry (PIV) Technology for Measurement and Analysis of Flow Patterns and Particle Distribution

Y. Zhang,* S. Zhang, Y. Sun, L. Y. Zhao
Illinois Council on Food and Agricultural Research

The long-term goal of the investigators is to develop technologies to measure and predict particulate contaminant spatial distribution for better design and management of air handling and distribution systems. In this study, the objectives are to develop a three-dimensional Steoroscopic Particle Imaging Velocimetry (SPIV) System for measurement of low speed airflow and particulate air contaminant transport and distribution and to evaluate the ventilation efficiency, particle removal effectiveness, and nonuniformity of indoor thermal environments in animal buildings. This project will provide fundamental measurement methodologies and techniques for other future studies. Data collected will be used to develop and evaluate a particulate spatial distribution model. Alternative air distribution systems and air quality control strategies will then be evaluated.

Development of an Aerodynamic Air Cleaning System to Improve Cooling Efficiencies for Combine Engines

Y. Zhang,* Z. C. Tan, A. C. Hansen, J. F. Reid
Deere & Company

Cooling efficiency of existing combine engines are reduced about 30% near the cleaning time and in extreme circumstances, may cause overheating of engines. To meet the cooling requirement, radiators and the cooling fan have to be large, which leads to high cost, high power consumption, high weight, and difficulties fitting into the given vehicle space. Existing cooling fans consume approximately 10% to 15% of the engine power on a typical combine. The research goal of this project is to improve cooling efficiency by developing efficient and economical air cleaning technologies and systems and reducing the maintenance requirements of cooling systems on off-road engines. The objective of this project is to develop an aerodynamic-deduster system to provide clean cooling air for the radiator.

Development of an Automatic Oil Sprinkling System to Reduce Dust and Odor from Swine Facilities

Y. Zhang,* B. J. He, G. L. Riskowski, T. L. Funk
Illinois Council on Food and Agricultural Research

A small quantity of vegetable oil sprinkled on swine facility floor surfaces has proven to be an effective and economical way to reduce odorous dust and odor in swine buildings. Previous research by the investigators was conducted using a manual oil sprayer, which is labor intensive. This proposed project is to develop an automatic oil sprinkling system to make this technology practical and economical for commercial swine facilities.

Thermochemical Conversion (TCC) of Swine Manure to Produce Fuel and Reduce Odor

Y. Zhang,* B. J. He, Y. Yin, K. C. Ocfemia,
T. L. Funk, G. L. Riskowski
Illinois Council on Food and Agricultural Research

Thermochemical conversion (TCC) is a chemical reforming reaction of organic compounds in a heated enclosure. Swine manure with 5% to 20% solid matter will be processed in a scale model TCC. The products are a light crude oil, gases, post-processed water, and solid fertilizer. The objective of this proposed research is to examine the critical solids content of manure at which the TCC can be a net energy producer; that is, when oil and gas produced are sufficient to operate the TDP processor. Critical solid content will be determined to balance the energy output and input.

* Denotes principal investigator.

Food and Bioprocess Engineering

The "Quick Fiber" Process to Enhance Dry-Grind Ethanol Profitability

S. R. Eckhoff,* K. D. Rausch, V. Singh, A. McAloon
Illinois Corn Marketing Board; Illinois Council on Food and Agricultural Research External Competitive Grants Program; Council of Great Lakes Governors; Illinois Biomass Energy Program

The "quick fiber" process recovers pericarp fiber from degerminated corn for use in dry-grind ethanol facilities. Optimal operating conditions are used to recover fiber and to determine the economic benefits to dry-grind ethanol producers removing the fiber. Preliminary analysis indicated approximately a $0.04 per gallon ($0.10 per bushel) advantage of the quick fiber process. Most of the economic benefit is from increased capacity in the fermentors. The fiber has also been shown to contain significant levels of cholesterol-lowering ferulate esters.

The "Quick Protein" Process to Enhance Dry-Grind Ethanol Plant Profitability

S. R. Eckhoff,* D. Gupta, L. Dickey, K. D. Rausch, V. Singh, M. E. Tumbleson
Illinois Corn Marketing Board

The objective of the study is to produce a protein rich fraction from corn which has already gone through the quick germ and quick fiber processes. This protein rich fraction will be looked at for the amount of zein that can be extracted.

Time and SO_2 Concentration on Steepwater Profiles and Corn Milling Yields Using a Continuous Countercurrent Steep System

S. R. Eckhoff,* K. D. Rausch, P. Yang
Campus Research Board

Effects of SO_2 concentration and steep time on corn steep profiles and milling results were studied using a countercurrent steep system. Corn was steeped at 50±2°C in different SO_2 levels (~1,000, ~2,000 and ~3,000 ppm) for different lengths of time (18, 24, 30, and 36 hr). Steepwater profiles for each condition were generated, steeped corn was milled, and average product yields were reported. Steeping can be viewed as a three-stage process: a lactic acid dominating state, an SO_2 absorption stage, and an SO_2 diffusion state. Starch yield can be significantly increased by increasing either steep time or SO_2 concentration.

Development of Processes to Recover and Utilize Agricultural Biosolids

K. D. Rausch,* S. R. Eckhoff, M. R. Paulsen, M. E. Tumbleson
U.S. Department of Agriculture Hatch funds

Coproducts contribute greatly to economic viability of the ethanol industry. Two streams, light gluten (LG) and light steepwater (LSW), are affected by processing conditions during wet milling of corn and vary in composition. These streams are precursors of corn gluten meal and corn gluten feed coproducts, used as animal foods. Variation in LG and LSW affect nutritional quality and market value of both coproducts. Materials not usable in LG or LSW streams become wastewater (WW) stream and incur costs. This study was to determine variation in composition of LG, LSW, and WW within and among processing days.

Influence of Corn Hybrid on Dry Milling and Extrusion Product Performance

K. D. Rausch,* J. F. Faller, S. R. Eckhoff
Illinois Council on Food and Agricultural Research

Commercial corn hybrids available in the market impact processing. Understanding the magnitude of variability caused by commercial hybrids would allow producers, millers, and processors to increase quality and value. Goals of this work were to evaluate the effect of hybrid on dry milling and extrusion variability and to identify added value that processing specific hybrids can provide to the final products. Hybrids grown on research plots were dry milled to obtain meal for subsequent extrusion. Differences in RVA characteristics were found between tail and through meal samples. Some differences in extruded products due to hybrid were detected.

Process Research to Enhance Nutritional Value of Corn Wet Milling Coproducts

K. D. Rausch,* S. R. Eckhoff, V. Singh, M. E. Tumbleson
Illinois Council on Food and Agricultural Research

Coproducts from corn wet milling must be dewatered and dried to allow economical and safe storage and handling prior to use in animal food. Protein and other nutrients are recovered currently as low valued animal food ingredients from wet milling. Microfiltration of coproduct streams is being investigated as a feasible alternative to centrifugation, evaporation, and vacuum belt filtration, and for reducing high capital and energy costs with these processes. The goals of this study are to investigate methods of recovering more nutrients and determining changes in value using microfiltration compared to conventional methods to allow industry to be more sustainable and efficient.

* Denotes principal investigator.

Relating Corn Hybrids to Enhanced Starch Processing Efficiency

K. D. Rausch,* P. Buriak, M. R. Paulsen, S. R. Eckhoff
Illinois Council on Food and Agricultural Research

Raw material variability is common for starch processors and is believed to be responsible for increased processing costs. These increased costs result from excess capacity and reduced processing rates to account for fluctuation in raw material quality. Reduction of variability in raw materials would enable processors to design modification processes that run efficiently with increased final product quality. In this study, the variability of starch modifications due to the influence of hybrid was quantified. It was found that effect of crop year appears larger than effect of hybrid on modified waxy starch properties.

Grain Qualities and Properties

Corn Starch Yield Calibrations with NIR

M. R. Paulsen*
Illinois Council on Food and Agricultural Research; U.S. Department of Agriculture

Extractable corn starch percentages are affected by variety, environmental, and drying conditions. Extractable corn starch varies from about 54% to 72% dry basis. A Foss Infratec 1229 was used to develop extractable starch calibrations based on a 100-g wet milling laboratory reference method. The NIT calibration achieved a standard error of performance (SEP) of 1.26, R-square of 0.85, and RPD (ratio of standard deviation/SEP) of 3.05. The calibration may be used as a rapid method for checking dried corn for extractable starch. Each percentage point gain in extractable starch is estimated to be worth 4 cents to 6 cents per bushel.

Information Agriculture

Development of an "On-Tractor" Information Manager for Crop Production Operations

Q. Zhang,* J. F. Reid
Illinois Council on Food and Agricultural Research

The objective of this research is to develop a farmer-oriented information management tool for crop production. Research is focused on the development of an "on-tractor" information management system, which will be capable of integrating precision agricultural devices, synthesizing available information, and supporting operation decision making. It will also be capable of linking the tractor to the Internet for receiving and transmitting operational information. This technology will utilize the current research results from precision agriculture, sensor and infotronic technology, and information management. This system will be evaluated under typical Illinois crop production conditions.

Mechatronics

Programmable Generic Electrohydraulic Valves

Q. Zhang,* A. Alleyne
National Fluid Power Association

The objectives are to prove the concept of programmable electrohydraulic valves and to enhance fluid power education. The research component of this project intends to develop a "soft" electrohydraulic valve, which serves as a generic base firmware for different applications with flexible software. This soft valve is capable of realizing the directional control, flow control, line release, and other functions with a specially developed control system. The education component of this project is intended to increase student involvement and interest in fluid power technology by offering courses and research opportunities in fluid power.

Off-Road Machinery

Soil Compaction Caused by Wheel Traffic

J. C. Siemens,* S. Han
University of Illinois

A soil compaction study is under way to determine effects of wheel and track traffic on crop growth and yield. Treatments include no extra traffic, extra traffic on every other row, and traffic over the entire plot area before planting. Crop yields have decreased due to soil compaction in some years, especially in years when compaction causes drainage to be inadequate.

* Denotes principal investigator.

Tillage Systems

J. C. Siemens,* S. Han
University of Illinois

Several tillage systems for crop production are being evaluated. Tillage treatments vary from moldboard plow or chisel plow to no-tillage systems for corn and soybean production. Principal factors being studied are crop establishment, growth, and yield; soil condition and fertility; soil erosion; weed control; and economics.

Automated Navigation Control for Agricultural Mobile Equipment with Guidance Sensors

Q. Zhang,* J. F. Reid
Case Corp.

This research intends to develop automated navigation technology, which will provide vehicle guidance information based on multiple guidance sensors, for agricultural equipment to perform various agricultural operations. This study will address changing technical problems in developing automated navigation control, including perception of confusing guidance information, identifying and compensating vehicle disturbances, and developing a high-performance steering controller. The lack of skillful operators, the aging of the farm labor force, and the application of new agricultural technology make this research technologically significant and important to society.

Fuzzy Controls for Mechatronized Off-Road Equipment

Q. Zhang,* J. F. Reid
U.S. Department of Agriculture Hatch Funds

This research is to develop an automated guidance control system for off-road equipment. The hypothesis of this research is that human operators, using their experience and common-sense intelligence, can maneuver off-road equipment well for all operations. One of the fundamental tasks is to guide a vehicle following a certain path. The specific objectives of this program are to develop redundant guidance sensing technology, a vehicle path planning technology, sensor fusion technology, and fuzzy controls for electrohydraulic steering control. This guidance control system has been partially developed and implemented on an agricultural tractor for use in crop production fields. Further efforts will be focused on the development of a sensor fusion-based vehicle path planner.

Intelligent Safety Sensing and Controls for Off-Road Equipment

Q. Zhang*
National Institute of Safety and Health Educational Resource Center

This research addresses an active safety assurance technology for off-road equipment. Off-road equipment is designed to perform operations while in motion. This often results in an unsafe work environment around the equipment for human-machine interaction. The key objectives are to develop an intelligent safety sensing technology for detecting human presence and a safety measure method for identifying a safety index around the operating equipment. The outcome of this research will be applicable technologies for on-vehicle intelligent human presence sensing, safety index identifying, and safety control overriding systems.

Site-Specific Agriculture

Site-Specific Crop Management

C. E. Goering,* J. Liu, L. Tian, R. Hornbaker, D. Bullock
University of Illinois

Setting realistic, spatially referenced yield targets is a key step in site-specific crop management. Using records from 30 years of corn production on the Morrow Plots, an artificial neural network (ANN) was trained to calculate corn yields as a function of the soil, weather, and management factors influencing such yields. The trained ANN predicted corn yields with an RMS error of approximately 20%. A genetic algorithm was used with the trained ANN to determine the combination of input factors producing maximum yield, which was about 75% greater than the maximum observed yield. The next step is to study whether the ANN can be retrained for fields with much smaller databases.

Development of Engineering Technologies for Precision Farming

S. Han*
U.S. Department of Agriculture Hatch Funds

This project fits into a larger program to develop sensing and variable-rate technologies to increase the on-farm profitability and to reduce the adverse environmental effects of agricultural fertilizers and chemicals. Specific objectives of this project are to develop multispectral imaging sensing technology for the assessment of crop nutrients and soil properties; to develop spatial decision

* Denotes principal investigator.

support systems for variable-rate nitrogen and herbicide recommendations; to develop application and control systems for variable-rate nitrogen and herbicide treatments; and to compare the agronomic, economic, and environmental benefits of the variable-rate management systems with the conventional, uniform-rate management systems.

Development of a Map-Based Variable-Rate Application System for Sprayers

S. Han,* J. F. Reid
Case Corp.; University of Illinois

The overall objective of this project is to develop a variable-rate fertilizer and chemical application system for agricultural sprayers. The system uses multiple layers of high-resolution raster maps and decision tables as inputs to generate site-specific prescriptions on-the-go, and then controls each individual sprayer nozzle to deliver the prescribed rate. A prototype system has been developed to apply in-season nitrogen fertilizer based upon aerial remote sensing images. Further development will focus on improvement of the spatial application accuracy for variable-rate chemical applications.

Development of a Precision Herbicide Application System

L. F. Tian,* J. W. Hummel
University of Illinois

The goal of this project is to develop a precision herbicide application (robotic) system for low-input pest control strategies in soybean and maize production. Specific objectives include evaluating the agronomic and environmental benefits of low-input herbicide applications and the status of current technology in this area; developing practical, real-time prototype systems for individual plant sensing and equipment control; and conducting on-farm trials to evaluate the prototype under the constraints of normal farm operation. With this precision system, herbicide would be applied only to the target weeds in the fields.

Hyperspectral Imaging System for SSCM and High-Density Data Analysis Technology with Supercomputer

L. F. Tian*
National Center for Supercomputing Applications Faculty Fellowship Program

Precision farming or site-specific crop management (SSCM) technology affords an opportunity for the producer to optimize crop input, increase crop quality, and reduce negative impacts on the environment. Researchers are integrating and evaluating a near-real-time agricultural remote sensing system, which includes real-time multifunction field property remote sensing, data processing, and a map generating system. The team is utilizing NCSA's computing and information technology to develop remote-sensing-based tools and procedures to map (diagnose) within-field variability. The research areas are remote sensing data visualization, variability data (map) mining, Web-based object relational databases, artificial intelligence, and decision support.

Data Collection and Analysis for Future Farms

L. Tian,* G. Schnitkey, M. Welge
Dudley Smith Foundations

High-quality data are essential for future crop management. Site-specific information will have higher value when the sensing system is optimized and error is minimized. This project is a pilot study to see what the future data set might be and how researchers could best plan to analyze it. The team will use state-of-the-art technologies in the development of sensing systems for future farms. High-performance computing systems will be used in the data management study. A prescriptive study will be conducted concerning the value of information from site-specific technologies.

Developing an Agricultural Remote Sensing Program at the University of Illinois

L. Tian,* D. Bullock, J. Westervelt
Sentinel Program of Illinois Council on Food and Agricultural Research

Cooperating with NASA researchers, University of Illinois scientists are expanding the agricultural remote sensing program at the U of I. Program objectives are to develop the key technologies needed for NASA remote sensing data applications in precision agriculture settings; design and develop new courses in the area of agricultural remote sensing, spatial data management, and precision agriculture; foster cooperation among scientists from universities, government agencies, and industry working in precision agriculture and remote sensing; and bring new technologies to farmers, assess their needs, target research to address those needs, and maximize the relevancy of the program.

* Denotes principal investigator.

Improved Application of Pest Control Substances

L. Tian*
University of Illinois; U.S. Department of Agriculture

Equipment and techniques are being developed to improve the application efficiency of agricultural chemicals. Droplet size spectra from various atomizers are measured to determine target coverage versus spray drift potential. Field studies of spray drift deposits are used to verify the droplet size evaluations. Sensors and automatic control systems are being developed to apply pest control substances as a function of soil organic matter, travel speed, and other input variables. Techniques for incorporation of herbicides in the soil profile of conservation tillage systems are being developed and evaluated.

Low-Input and Nonchemical Weed Control System

L. Tian,* J. F. Reid
University of Illinois

In an effort to reduce herbicide application amounts, this research will integrate a machine vision-sensing system with a herbicide sprayer system to create an intelligent sensing and mapping system for pest control. Researchers will first develop a real-time plant-sensing and spraying system based on field experiments to characterize the plant features that can be used for crop detection. The integrated system will be field tested under varying field conditions. Outcomes of this research will provide a system for increasing farm sustainability and protecting water quality through precision application of herbicides. The vision technology will provide a precision sensor that can be further developed for precision mapping of field weed infestations and vehicle guidance.

Using Remotely Sensed Data to Diagnose Soybean Yield Limiting Factors

L. Tian,* D. Bullock
North Central Soybean Research Program

Procedures to accurately explain crop yield variation are needed to provide crop consultants, producers, and researchers with the necessary information to interpret yield maps and develop the most appropriate site-specific management options for a given field. These site-specific options, based on factors that affect crop yield, will improve profitability. The objective of this project is to develop sensor-based procedures to map within-field weed, disease, and nutrient deficiencies in order to diagnose their presence in the field and evaluate their contribution to yield variation. This could lead to development of site-specific management options for crop production.

Variable Rate Herbicide Using Remotely Sensed Imagery

L. Tian,* L. Wax, C. Sprague
NASA CRSP Ag20/20 Initiative

An estimated $6.1 billion was spent by farmers on herbicides in 1997. Current methodology for weed control is to apply the herbicide uniformly throughout the field. However, weeds do not grow uniformly in the field, but often grow in patches with up to 94% of the field being weed-free. This means that a major portion of the field may not need to be sprayed. The goal of the variable-rate technology using remote sensing is to evaluate the effectiveness of remote-sensing-based, variable-rate herbicide in terms of cost savings, effectiveness in eliminating weeds, and ability to maintain acceptable yield levels compared to traditional, conventional application of herbicide.

"Smart Sprayer" Expert System for Site-Specific Weed Management

L. Tian,* J. F. Reid
Illinois Council on Food and Agricultural Research

The objective of this project is to capitalize on the new "smart sprayer" technology to prevent agricultural pollution from the overuse of pesticides. Detailed diagnostics are expected to reveal how the system design affects the overall performance so that the technology can be further optimized and brought closer to commercialization. The team will improve the computer-vision guided smart sprayer system to create a local (field) environment-aware applicator as the research platform.

Soil and Water Resources

Aerial Infrared Mapping of Subsurface Drainage Systems

R. A. Cooke,* M. C. Hirschi, J. D. Davis
Illinois Council on Food and Agricultural Research

The primary objective of this project is to provide researchers, farmers, farm managers, policy makers, farm organizations, and agribusiness interests in Illinois with maps that show the layout of subsurface drainage (tile) systems in the Lake Decatur Watershed, one of the most heavily tiled watersheds in the state. Drain (tile) mapping

* Denotes principal investigator.

is possible because the soil over efficiently draining tile lines dries faster than the soil at other locations in the field and has higher reflectance in the infrared region of the radiation spectrum.

Incorporation of the Effect of Artificial Subsurface Drainage into Surface Water Quality Models

R. A. Cooke*
University of Illinois

Most of the agricultural lands in central Illinois are drained by artificial subsurface drains. These drainage systems provide pathways for solute movement to rivers and streams. The goal of this project is to incorporate the effects of these systems into watershed-scale flow and transport models.

An Integrated Approach to Reduce Pathogen and Nutrients in Runoff from Animal Production Systems

P. K. Kalita,* M. S. Kuhlenschmidt,
R. D. Smith, T. L. Funk
Illinois Council on Food and Agricultural Research; University of Illinois

Microbial pathogens such as *Cryptosporidium parvum* and *Escherichia coli* from animal production facilities have threatened rural health and environment. The goal of this study is to limit the delivery of microbial pathogens and nutrients from animal production facilities and to provide a healthy and sustainable environment to small and mid-size farmers. This study is investigating the fate and transport of *C. parvum* and *E. coli* in surface and near-surface water to develop management strategies to limit their transport. A microbial transport predictive model will be developed with goals of understanding, predicting, and limiting microbial pathogen to the water supply.

DHARMA: Domain Specific Metaware for Hydrologic Applications

P. K. Kalita,* M. C. Hirschi
National Science Foundation

Many hydrologic models at the watershed scale are limited in resolution and scope by their computational demands. A goal of this project is to build a middleware layer to provide the resources for revolutionizing hydrologic modeling. The required resources range from local data to the supercomputing power on the national computational grid. Researchers intend to expand the applicability of the Water Erosion Prediction Project model to large watersheds, specifically applying the extended model to the Lake Decatur Watershed in Illinois, and enable the model for predicting erosion within the watershed by allowing significantly easier access to the computational power and data acquisition capabilities.

Understanding and Modeling the Hydrology of Tile-Drained Watersheds

P. K. Kalita,* R. A. Cooke, M. C. Hirschi, J. K. Mitchell
Illinois Council on Food and Agricultural Research; University of Illinois

The overall objective of the study is to develop strategies that mutually benefit both agriculture and water quality in regions where hydrology is strongly influenced by subsurface drainage. Researchers have been monitoring flow and water quality from the subsurface tile drains in the Little Vermilion River Watershed in Illinois. Results from field observations have been used to develop fundamental relationships describing flow components to incorporate in computer simulation models. These data have been used to calibrate and validate these models. Work is in progress to develop watershed-scale model(s) to evaluate the effects of Best Management Practices on watershed water quality.

Management Practice Effects on Nitrate-N Concentrations in the LVR

J. K. Mitchell,* M. C. Hirschi, G. F. McIsaac
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Nitrates in subsurface tile flow have been monitored for 6 to 8 years from fields with various tillage and cropping management practices. The effect of the application of large amounts of nitrogen fertilizer, particularly as a preplant operation, was shown in the nitrate-N concentrations from the drains. The preplant anhydrous-N application systems with average nitrogen application of 107 kg/ha/yr had a mean concentration of nitrate-N of 16.8 mg/L in the tile drain outflow. Side-dress and manure applications systems with average nitrogen application of 93 kg/ha/yr had a mean concentration of nitrate-N from a permanent meadow field of 1.0 mg/L.

* Denotes principal investigator.

Water Quality

Effect of Drainage System Layout on Yield, Yield Uniformity, and Water Quality

R. A. Cooke,* P. K. Kalita
Case Corp.; Illinois Council on Food and Agricultural Research

The overall goal of this research is to improve the characterization of subsurface drainage processes in tile-drained watersheds and to quantify the effect of several depth and spacing combinations on yield, yield uniformity, and water quality. In the long run, the results can be used to select subsurface drainage management practices that optimize yield, water quality, or both.

Passive Subsurface Bioreactors for Enhanced Edge-of-Field Treatment of Tile Outflow

R. A. Cooke,* M. C. Hirschi
Illinois Council on Food and Agricultural Research

This research project is designed to test the hypothesis that the installation of passive subsurface bioreactors on tile outlets will reduce the levels of nutrients and pesticides in streams and rivers. Research involves a laboratory study to determine the substrate (carbon source) that results in the highest removal efficiencies for nitrates and phosphorus, and the establishment of a pilot system for field validation and for demonstration purposes.

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He, B. **Thermochemical conversion of swine manure to produce oil and reduce waste.** Ph.D. thesis, Y. Zhang, adviser (2000).

Hussey, R. **Development of an air-supported structure to reduce gas emissions from an earthen lagoon.** M.S. thesis, Y. Zhang, adviser (2000).

Wang, X. L. **Measurement and modeling of spatial distribution of particulate matter in indoor environments.** Ph.D. thesis, Y. Zhang, adviser (2000).
Zhao, L. Y. **Measurement and analysis of full-scale room airflow using particle image velocimetry (PIV) techniques.** Ph.D. thesis, Y. Zhang, adviser (2000).

Food and Bioprocess Engineering

Shukla, R. **Production of zein from dry milled corn by solvent extraction and ultrafiltration.** Ph.D. thesis, M. Cheryan, adviser (2000).

Tian, Y. **Effect of hybrid and physical properties of individual popcorn kernels on expansion volume.** M.S. thesis, S. R. Eckhoff, adviser (2000).

Wilkins, M. R. **The effects of hybrid on waxy maize starch acetylation.** M.S. thesis, K. D. Rausch, adviser (2000).

Wungtanagorn, R. **Phenomenological study of enthalpy relaxation and physical aging of glucose, fructose, and their mixtures.** Ph.D. thesis, S. Schmidt, adviser (2000).

Zhang, T. **Thin-layer corn drying data acquisition system with genetic algorithms and effects of drying conditions on extractable starch.** M.S. thesis, M. R. Paulsen, adviser (2000).

Off-Road Equipment Engineering

Gopalapillai, S. **Remote sensing for precision farming within field spatial variability analysis and mapping with aerial digital multispectral images.** Ph.D. thesis, L. Tian, adviser (2000).

Liu, J. **Neural networks for setting target corn yields.** Ph.D. thesis, C. E. Goering, adviser (2000).

Mendoza, M. C. **Performance and durability of compression ignition engines fueled by oxydiesel.** M.S. thesis, Q. Zhang, adviser (2000).

Pinto, F. **Vision sensing for automated tractor guidance—a pose determination approach.** Ph.D. thesis, J. F. Reid, adviser (2000).

Price, R. A. **A real-time core extraction system for soil nitrates.** Ph.D. thesis, J. W. Hummel, adviser (2000).

Qi, Q. **Modeling and optimal control of a production line containing a wrapping system.** M.S. thesis, S. Morris, adviser (2000).

Viall, E. N. **Determining the discharge coefficient of a spool valve.** M.S. thesis, Q. Zhang, adviser (2000).

Wu, K. **Modeling of a hardware-in-the-loop powertrain simulator for off-road vehicles.** M.S. thesis, Q. Zhang, adviser (2000).

Soil and Water Resources Engineering

Christopher, K. I. **MODRAIN—modified DRAINMOD for random and irregular networks.** M.S. thesis, R. A. Cooke, adviser (2000).

Lander, K. S. **Quantifying base flow to a drainage channel in a tile-drained watershed.** M.S. thesis, P. K. Kalita, adviser (2000).

Yuan, Y. **Tile-drained watersheds SCS-curve number model.** Ph.D. thesis, J. K. Mitchell, adviser (2000).

Water Quality

Zuercher, J. K. **Effect of water table management on nitrate concentration from retrofitted drainage systems.** M.S. thesis, R. A. Cooke, adviser (2000).

Awards and Honors

Robert A. Aherin
Maynard Coe National Agriculture Safety Award, National Institute for Farm Safety, 1980
Educational Aids Competition Blue Ribbons, American Society of Agricultural Engineers, 1980 (3), 1981 (4), 1982 (3), 1984 (3), 1986 (2), 1988, 1989, 1990
Outstanding Young Men of America Award, National Jaycees, 1981
Honorary State Farmer Degree, Minnesota FFA Association, 1983
Outstanding Service Award, American Lung Association, 1983
Agriculture Safety Professional-of-the-Year Award, Minnesota Safety Council, 1983
Packer Engineering Safety Award, American Society of Agricultural Engineering, 1987
Teaching Award—Program, American Society of Agricultural Engineers, 1989
Young Faculty Award for Excellence in Extension, U of I College of Agriculture, 1993

Paul W. Benson
Illinois Electric Council Merit Award, 1991
Teaching Excellence Award, U of I Department of Agricultural Engineering, 1993

Honorary State Farmer Degree, Illinois Association FFA, 1998
Professional Staff Award for Excellence, Sustained Excellence, U of I College of Agricultural, Consumer and Environmental Sciences, 1999

Loren E. Bode
Fellow, American Society of Agricultural Engineers
Educational Aids Competition Blue Ribbons, American Society of Agricultural Engineers, 1976, 1981, 1982, 1985, 1986, 1988, 1993
Paper Award—Honorable Mention, American Society of Agricultural Engineers, 1982
Young Extension Worker Award, American Society of Agricultural Engineers, 1983
Senior Faculty Award for Excellence in Extension, U of I College of Agriculture, 1990
Midwest Agricultural Chemical Association Educator's Award, 1991
Paul A. Funk Achievement Award, U of I College of Agriculture, 1993

Douglas L. Bosworth
Fellow, American Society of Agricultural Engineers
President, American Society of Agricultural Engineers, 1992-93
General Electric Scholar, U of I College of Engineering, 1998-2000

Philip Buriak
Teaching Award of Merit, National Association of College Teachers of Agriculture, 1986
Honorary American Farmer Degree, National FFA Organization, 1987
Paper Award—Outstanding Research Presentation, National Agricultural Education Research Meeting, 1988
Teaching Excellence Award, U of I Department of Agricultural Engineering, 1989, 1992, 1994
Karl E. Gardener Outstanding Undergraduate Advising Award, U of I College of Agriculture, 1993
Author of the Year, 1st Runner Up, Journal of Agriculture Education, 1994
Author of the Year, 2nd Runner Up, Journal of Agricultural Education, 1997
Honorary Illinois Farmer Degree, Illinois Association FFA, 1997
Teaching Award of Excellence, U of I College of Agricultural, Consumer and Environmental Sciences, 1997
Senior Teaching Award of Excellence, U of I College of Agricultural, Consumer and Environmental Sciences, 1999
Teaching Academy of Excellence, U of I College of Agricultural, Consumer and Environmental Sciences, 1997-2002
Undergraduate Teaching Award of Excellence, U of I, 1999
National Award for Excellence in College and University Teaching, U.S. Department of Agriculture, 1999
Distinguished Teacher/Scholar, U of I, 2000

Leslie L. Christianson
Teaching Excellence Award, U of I Department of Agricultural Engineering, 1987, 1991
Stanley H. Pierce Award, U of I College of Engineering, 1989
Andersen Consulting Award for Excellence in Advising, U of I College of Engineering, 1989, 1990, 1991
Paper Award, American Society of Agricultural Engineers, 1994

Richard C. Coddington
Teaching Excellence Award, U of I Department of Agricultural Engineering, 1988, 1992
Amoco Award for Innovative Teaching, 1991

Richard A. Cooke
Dissertation Research Award, Virginia Polytechnic Institute and State University Chapter of Sigma Xi, 1995

James O. Curtis, Emeritus
Fellow, American Society of Agricultural Engineers

Donald L. Day, Emeritus
Fellow, American Society of Agricultural Engineers
Paper Reviewers Award, American Society of Agricultural Engineers, 1989
Certificate for Distinguished Paper, University of Guadalajara, Mexico, 1990
Research Fellowship, Japan Society for Promotion of Science Travel, 1992

Steven R. Eckhoff
Dow Outstanding Young Educator Award in the Midwest Region, American Society for Engineering Education, 1986
Kansas State University Presidential Lecturer, 1986, 1987
Outstanding Paper in Cereal Chemistry Award, Corn Refiners Association, 1989
Research Fellowship, Corn Refiners Association, 1990, 1991
Teaching Excellence Award, U of I Department of Agricultural Engineering, 1993

Excellence in Teaching Award, American Association of Cereal Chemists, 1999

Ted L. Funk
Sustained Excellence in Extension Programming, U of I College of Agriculture, Consumer and Environmental Sciences, 1999
Outstanding Program Team Award in Extension, U of I College of Agriculture, Consumer and Environmental Sciences, 1999

Carroll E. Goering, Emeritus
Fellow, American Society of Agricultural Engineers
Outstanding Technical Paper Awards, American Society of Agricultural Engineers, 1985, 1990, 1992; honorable mention, 1986, 1989
Everitt Award for Teaching Excellence, U of I College of Engineering, 1986
Senior Faculty Award for Teaching Excellence, U of I College of Agriculture, 1994
Paul A. Funk Recognition Award, U of I College of Agricultural, Consumer and Environmental Sciences, 1996

Alan C. Hansen
Paper Award—Outstanding Technical, American Society of Agricultural Engineers, 1990
Silver Medal for Academic Achievement, South African Institute of Agricultural Engineers, 1990
Silver Medal for Best Publication of the Year, South African Institution of Mechanical Engineers, 1992
Silver Medal for Best Paper Published, South African Institute of Agricultural Engineers, 1992
Faculty Award for Excellence in Teaching, University of Natal, Faculty of Engineering, South Africa, 1994, 1996

Michael C. Hirschi
Paper Reviewers Award, American Society of Agricultural Engineers, 1988
Educational Aids Competition Blue Ribbons (5), American Society of Agricultural Engineers, 1991 (3), 1994, 1998
Early Career Award, Epsilon Sigma Phi Alpha Nu Chapter, 1992
Young Faculty Award for Excellence in Extension, U of I College of Agricultural, Consumer and Environmental Sciences, 1995
Teaching Excellence Award, U of I Department of Agricultural Engineering, 1997
Certificate of Excellence, American Society of Agronomy Education Materials Contest, 1998
Accenture Consulting Outstanding Advisor Award (U of I College of Engineering), 2000

Donnell R. Hunt, Emeritus
Fellow, American Society of Agricultural Engineers

Donald G. Jedele, Emeritus
Fellow, American Society of Agricultural Engineers
Rural Builder Hall of Fame, Rural Building News, 1987
Certificate of Merit, Illinois Farm Electrification Council, 1988

Benjamin A. Jones, Jr., Emeritus
Fellow, American Society of Agricultural Engineers

Prasanta K. Kalita
Research Excellence Award, Iowa State University, 1992
Who's Who in Science and Engineering, 1996
Advisor of the Year, Kansas State University College of Engineering, 1996
Outstanding Kansas State University Instructor and Advisor by K-State Mortar Board, 1997
Most Outstanding Advisor of the Year, Kansas State University BAE Department, 1997
Who's Who Among America's Teachers, 1998, 2000
Finalist, President's Outstanding Advisor Award, Kansas State University, 1999
Collins Scholar, The Academy for Excellence in Engineering Education, U of I, 2000

J. Bruce Litchfield
Andersen Consulting Award for Excellence in Advising, U of I College of Engineering, 1989, 1993
Teaching Excellence Award, U of I Department of Agricultural Engineering, 1990
Everitt Award for Teaching Excellence, U of I College of Engineering, 1991
Research Fellowship, Corn Refiners Association, 1991
Young Faculty Award for Excellence in Teaching, U of I College of Agriculture, 1992
A. W. Farrall Young Educator Award, American Society of Agricultural Engineers, 1993
University Scholar, U of I, 1994
Engineering Council Advisors List for Outstanding Advising, U of I, 1995
Faculty Award for Excellence in Research, College of Agricultural, Consumer and Environmental Sciences, U of I, 1996
Harriet and Charles Luckman Undergraduate Distinguished Teaching Award, U of I, 1997
Collins Award for Innovative Teaching, U of I College of Engineering, 1997

J. Kent Mitchell, Emeritus
Fellow, American Society of Agricultural Engineering
Educational Aids Competition Blue Ribbons, American Society of Agricultural Engineers, 1972, 1975, 1979, 1984
Alpha Zeta Outstanding Instructor, U of I College of Agriculture, 1986
Teaching Excellence Award, U of I Department of Agricultural Engineering, 1986
Everitt Award for Teaching Excellence, U of I College of Engineering, 1987
Faculty Award for Excellence in Teaching, U of I College of Agriculture, 1989
Paul A. Funk Recognition Award, U of I College of Agriculture, 1994

Arthur J. Muehling, Emeritus
Fellow, American Society of Agricultural Engineers
Educational Award, Illinois Pork Producers Association, 1974
Paul A. Funk Award, U of I College of Agriculture, 1979
Farm Builder Hall of Fame, Rural Builder Magazine, 1984
University of Illinois Cooperative Extension Award for Sustained Excellence, 1985
Bernon G. Perkins Award, National Farm Builders Association, 1993

Elwood F. Olver, Emeritus
Fellow, American Society of Agricultural Engineers

Marvin R. Paulsen
Fellow, Committee on Institutional Cooperation, 2000-2001

Roscoe L. Pershing
Fellow, American Society of Agricultural Engineering

William H. Peterson, Emeritus
Appreciation Plaque, South Dakota Rural Electric Member Services Association, 1977
Educational Aids Competition Blue Ribbons, American Society of Agricultural Engineers, 1981, 1983, 1987
Certificate of Appreciation, Illinois Farm Electric Council, 1981
Certificate of Merit, Illinois Electric Council, 1996

Hoyle B. Puckett, Emeritus
Fellow, American Society of Agricultural Engineers

Gerald L. Riskowski
Educational Aids Competition Blue Ribbons, American Society of Agricultural Engineers, 1983, 1985 (3), 1987, 1988, 1990, 1992
Outstanding Reviewer, American Society of Agricultural Engineers, 1990
Teaching Excellence Award, U of I Department of Agricultural Engineering, 1991
Andersen Consulting Award for Excellence in Advising, U of I College of Engineering, 1991
Young Faculty Award for Excellence in Teaching, U of I College of Agriculture, 1993
Paper Award, American Society of Agricultural Engineers, 1994, 2000
Rural Builders Hall of Fame, 1998

Errol D. Rodda, Emeritus
Stanley H. Pierce Award, U of I College of Engineering, 1977

John C. Siemens, Emeritus
Educational Aids Competition Blue Ribbon, American Society of Agricultural Engineers, 1985
Agronomic Educational Material Publication, American Society of Agricultural Engineers, 1992
Senior Faculty Award for Excellence in Extension, U of I College of Agriculture, 1993
John Deere Gold Medal Award, American Society of Agricultural Engineers, 1999

Lei Tian
Novel Academic Idea Award for Young Faculty, Jilin University of Technology, 1988
Recipient, Novel Academic Idea Award for Young Educator, Jilin University of Technology, 1989
Nominee, CGS Award for most distinguished dissertation of the program, Department of Biological and Agricultural Engineering, University of California at Davis, 1995
Nominee, University Microfilms International Distinguished Dissertation Award in Mathematics and Physics and Engineering, University of California for National Council of Graduate Schools, 1995
Nominee, Kinsella Memorial Prize, University of California at Davis, 1995
Outstanding Accomplishment of Training on Teaching College, U of I College of Agricultural, Consumer and Environmental Sciences Academy of Teaching Excellence, 1997
Superior Paper Award, American Society of Agricultural Engineers, 1999-2000
Honorable Mention for the Graduate College of Outstanding Mentor Award, U of I College of Graduate Studies, 1999-2000
Faculty Fellow, National Center for Supercomputing Applications U of I, 2000-2001

Roger R. Yoerger, Emeritus
Fellow, American Society of Agricultural Engineers
Past National President, Phi Kappa Phi
Massey-Ferguson Award, American Society of Agricultural Engineers, 1989

Qin Zhang
General Electric Scholar, U of I College of Engineering, 1998
Collins Award for Innovative Teaching, U of I College of Engineering, 1999

Yuanhui Zhang
Outstanding Paper Award, American Society of Agricultural Engineers, 1989
Honorarium Professorship, Shadong Institute of Technology, China, 1994
Honorarium Professorship, Beijing University of Agricultural Engineering, China, 1994
Everitt Award for Teaching Excellence, U of I College of Engineering, 1997
General Electric Scholar, U of I College of Engineering, 1997
Blue Ribbon Award, American Society of Agricultural Engineers, 1998
Teaching Excellence Award, U of I Department of Agricultural Engineering, 1999